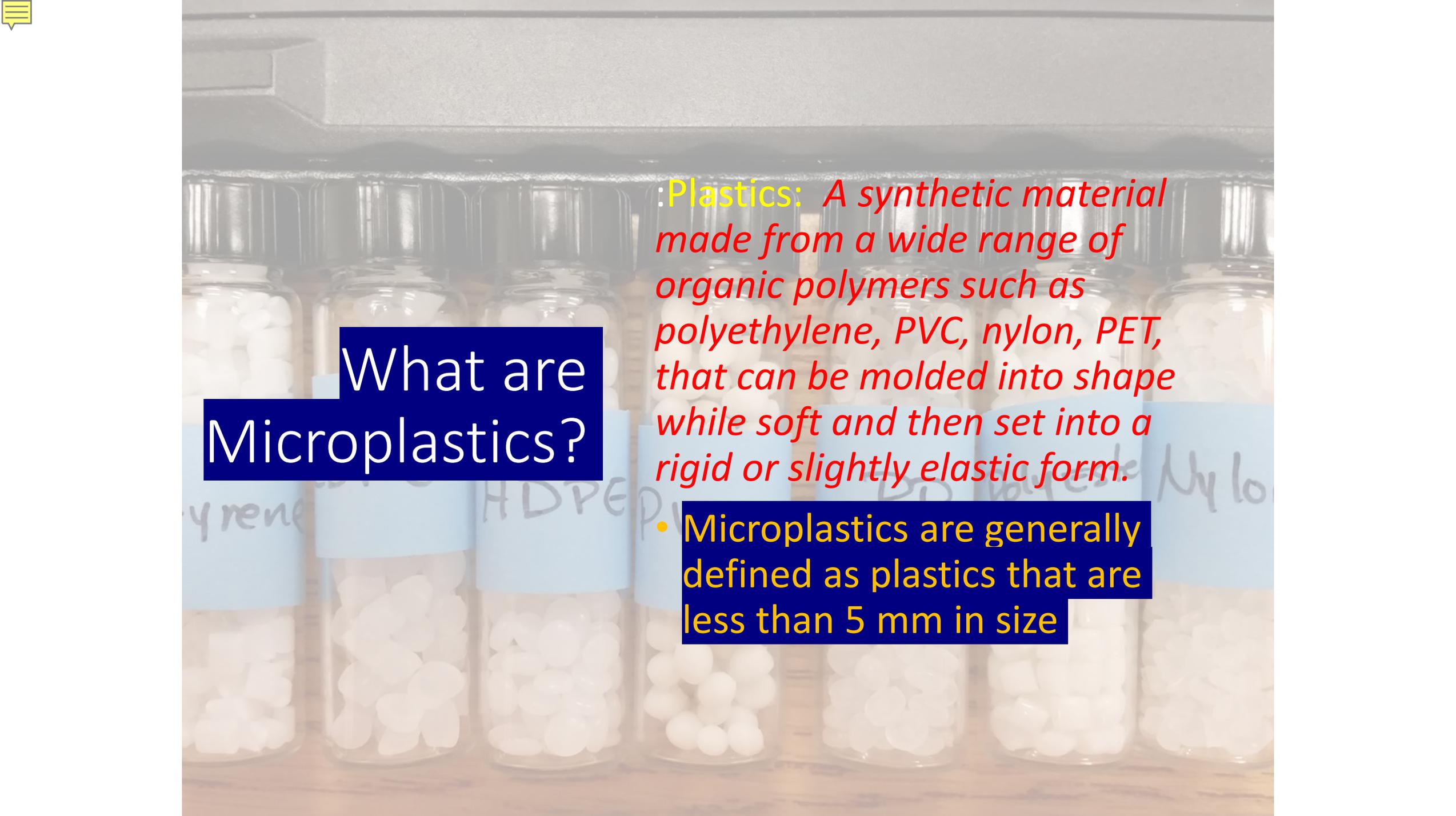


# Dealing With Microplastics

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## What are Microplastics?

**Plastics:** *A synthetic material made from a wide range of organic polymers such as polyethylene, PVC, nylon, PET, that can be molded into shape while soft and then set into a rigid or slightly elastic form.*

- Microplastics are generally defined as plastics that are less than 5 mm in size

# Microplastic ?

Microplastics are tiny plastic particles up to 5 mm in diameter.

In the last four decades, concentration on these particles appear to have increased significantly in the surface waters of the ocean.

*Source:*

- Marine Pollution Bulletin 68 (2013)

<http://www.abc.net.au/news/2013>

- Cole M, Lindeque P, Fileman E, Halsband C, Goodhead RM, et al. (2013) Microplastic ingestion by zooplankton. Environmental Science & Technology 47: 6646–6655. doi: 10.1021/es400663f



# Microplastics



- Plastics smaller than 5 mm
- 80% of marine litter is microplastics
- Primary: manufactured for direct use (scrubs, toothpaste) or indirect use (pellets)
- Secondary: formed by fragmentation of larger plastic items, fibres from washing clothes, car tires, boat paint etc
- Contain chemicals and can absorb and concentrate contaminants (eg pesticides) from surrounding seawater
- Ingestion of microplastics harms physiology of organisms and compromise their fitness
- Risk that it travels the food chain higher up to human consumption!

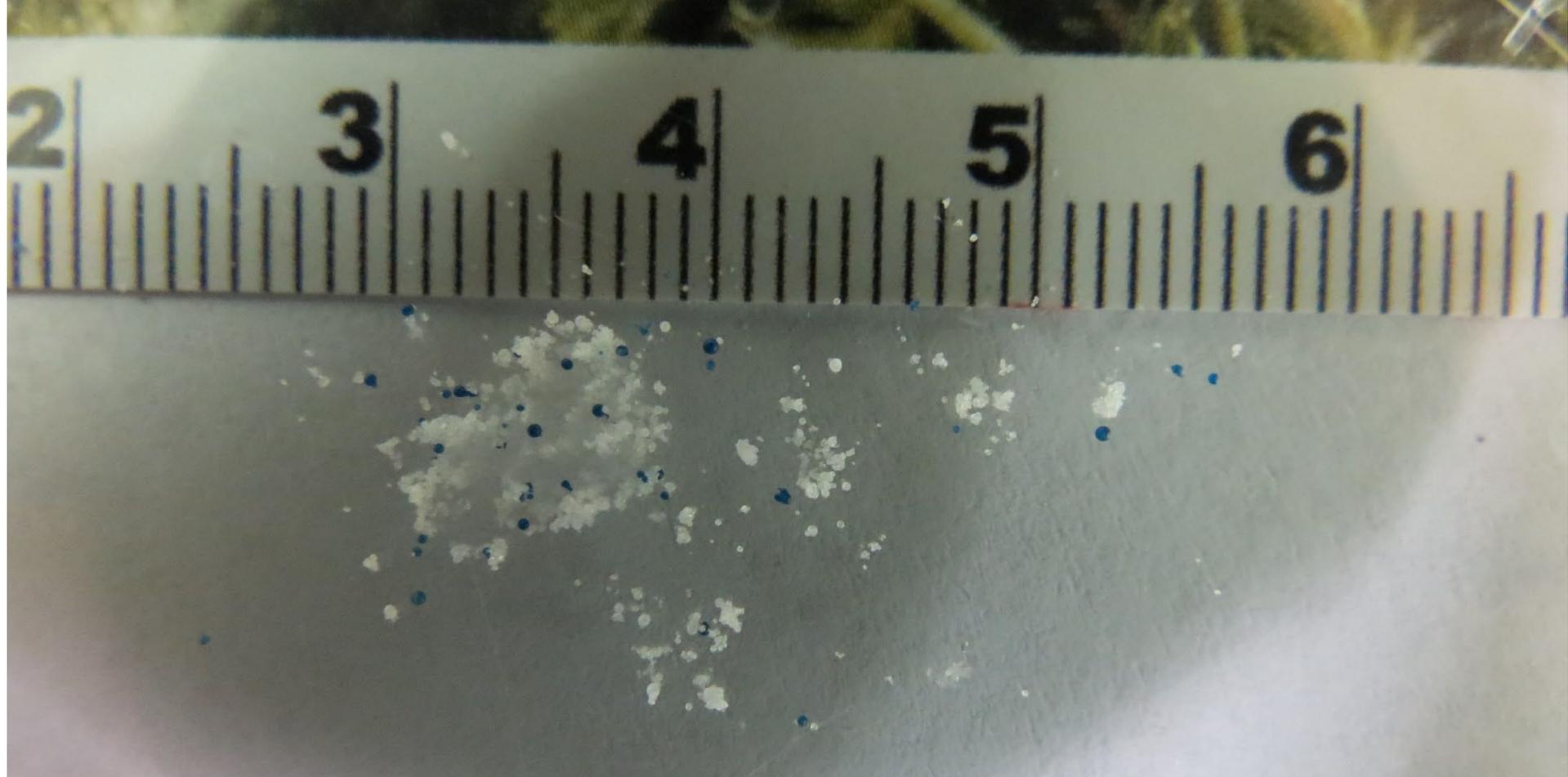


Primary microplastics “Nurdles”



# Secondary microplastics

Pieces from degradation of larger plastic items

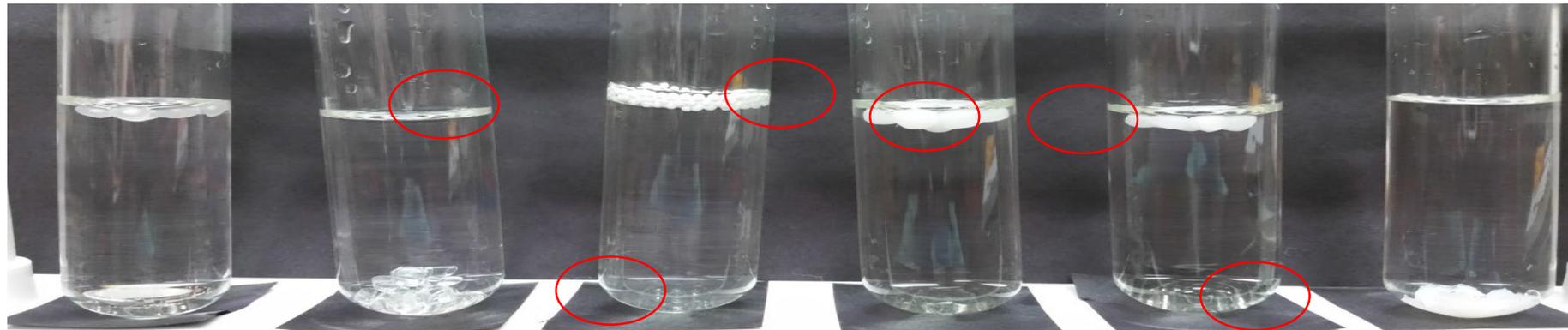


Primary microplastics “Microbeads”

# Campuran Primary dan Secondary

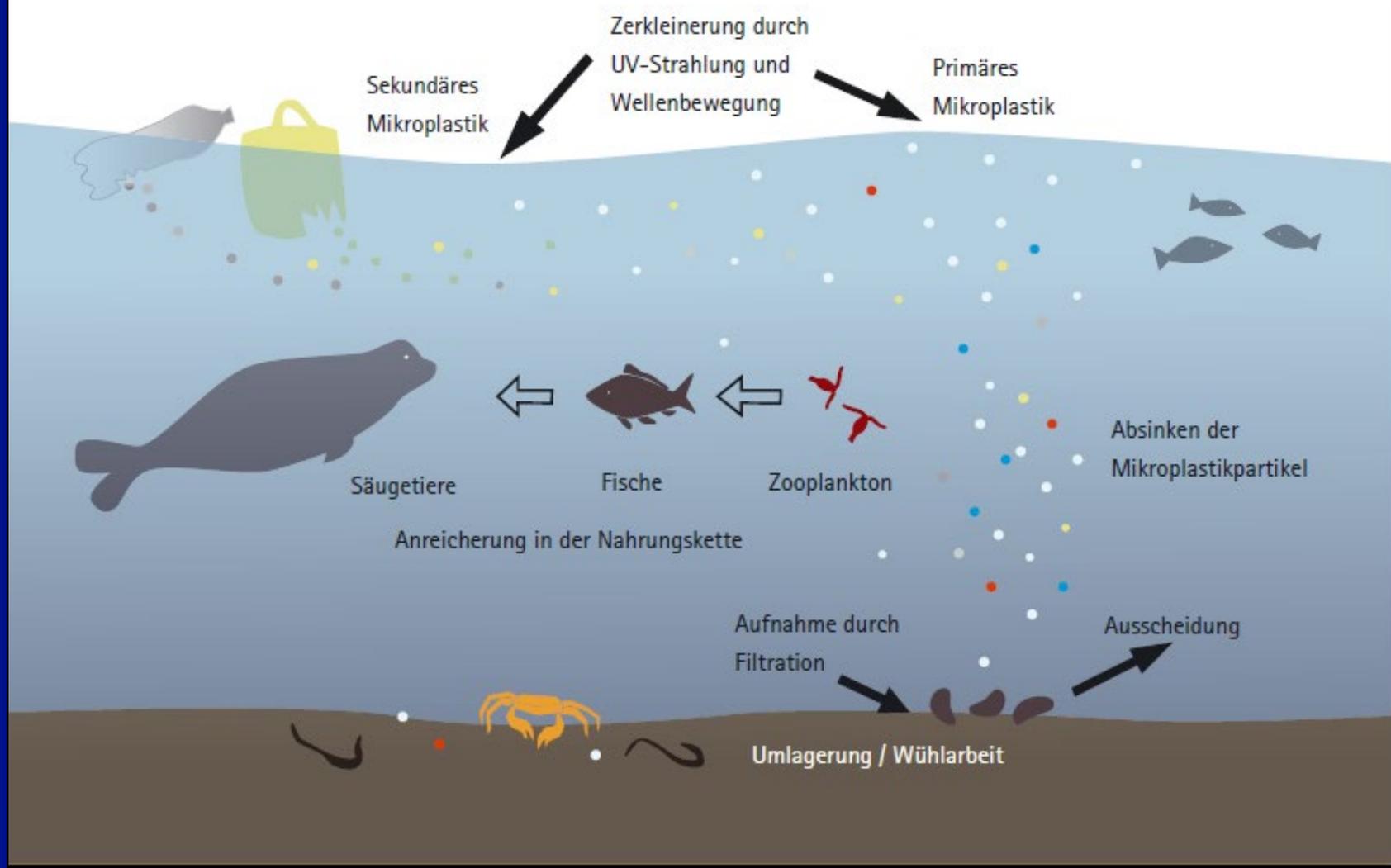


- Primary Microplastic



- Densiti bermacam polimer elastif terhadap air.

# The pathway of microplastics in the marine environment



# Mengapa Perlu Beri Perhatian Pada Microplastic?

- Mereka ada di Lingkungan dan makin banyak
- Tidak mengalami bidegradasi
- Dikonsumsi oleh hewan laut

**TOXINS ARE IN THE OCEAN**

**PLASTICS ARE IN THE OCEAN**



**TOXINS REALLY LIKE TO STICK TO PLASTIC...**

**ANIMALS EAT PLASTIC**



**TOXINS GET INTO ANIMALS**



[www.plasticaware.org](http://www.plasticaware.org)  
#plasticaware  
#microplasticawarenessmonth

# Apa yang perlu kita lakukan

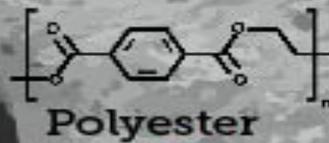
- Reduce, reuse, recycle, refuse
- Check labels on personal care products
- Participate in beach cleanups, and look for the very small plastics



# DID YOU KNOW?

The threads we love to wear are not always friendly swag for the environment.

Today's sportswear often consists of two petroleum-based fibers.

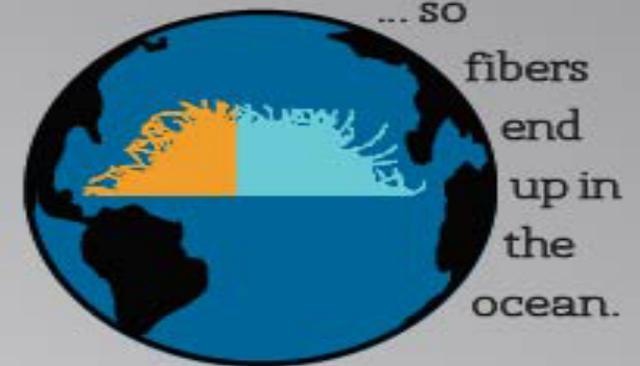
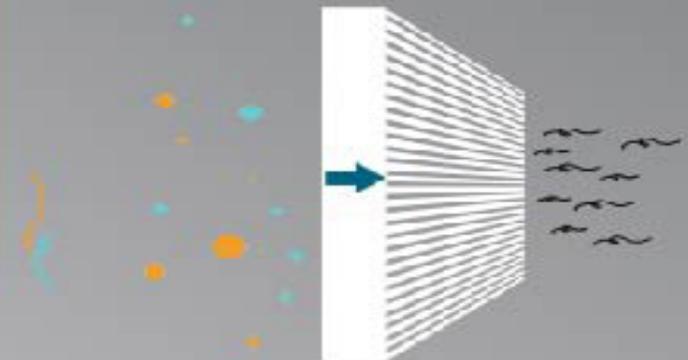


Together, these synthetic microfibers create stretchy, breathable clothing.

But more of these fibers shed off with every wash.



Wastewater treatment plants can't filter out all microfibers ...



## What can you do to help?

Stick to natural fibers!

Unlike synthetic microfibers, these natural fibers will break down in the environment.

Cotton



Hemp



Linen



[www.plasticaware.org](http://www.plasticaware.org)

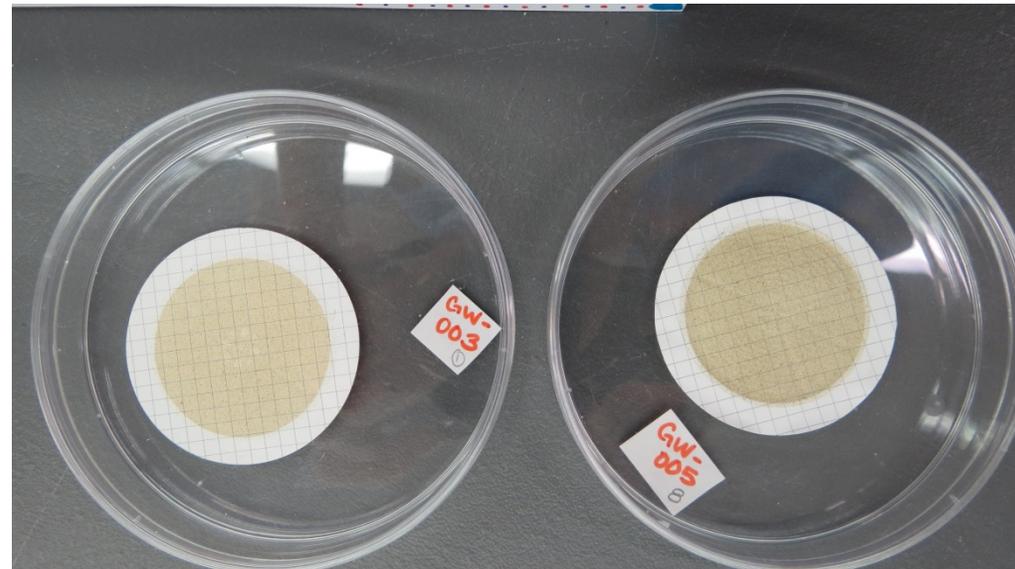


# Sampling protocol (check out our YouTube channel!)

- Volunteers choose their sampling site
- On a calm day (preferably), they collect their sample.



- The samples can sit (and preferably should sit for at least a few days) before being filtered.
- Samples are filtered through 0.45 micron gridded 47-mm filters.



# Microplastic Potensial from river way



Plastic fragments found in 5-week old rainbow runner caught at 23°05.35N, 147°12.86W on August 13, 2008.



[www.algalita.org](http://www.algalita.org)

# Toxicity of Microplastic ?

Marine species	Microplastic exposure and effect	Reference
Blue mussel <i>Mytilus edulis</i>	Absorption of 1-80 µm MPs <b>Granulocytoma formation</b> (inflammation) Increase in SB haemocytes, <b>Decrease in lysosome stability</b>	Koehler & von Moos, 2010
Blue mussel <i>Mytilus edulis</i>	Exposure to 10, 30 90 µm MPs Indications for selective uptake of 10 µm MPs <b>Reduced clearance rate</b>	Van Cauwenberghe, 2012
Blue mussel <i>Mytilus edulis</i>	Exposure to/absorption of 30 nm PS causes <b>reduced valve opening and filtering activity</b>	Wegner et al. 2012
Phytoplankton <i>Scenedesmus</i>	Adsorption of 20 nm PS <b>Hindered algal photosynthesis</b> and promotion of algal ROS indicative of oxidative stress	Bhattacharya et al. 2010
Carp species <i>Carassius carassius</i>	Absorption of 24 nm NPs Food chain transport of NPs <b>affects behaviour and fat metabolism</b>	Cedervall et al. 2012

# Microplastic dan Particle Toxicity

## Microplastics effects on mammals

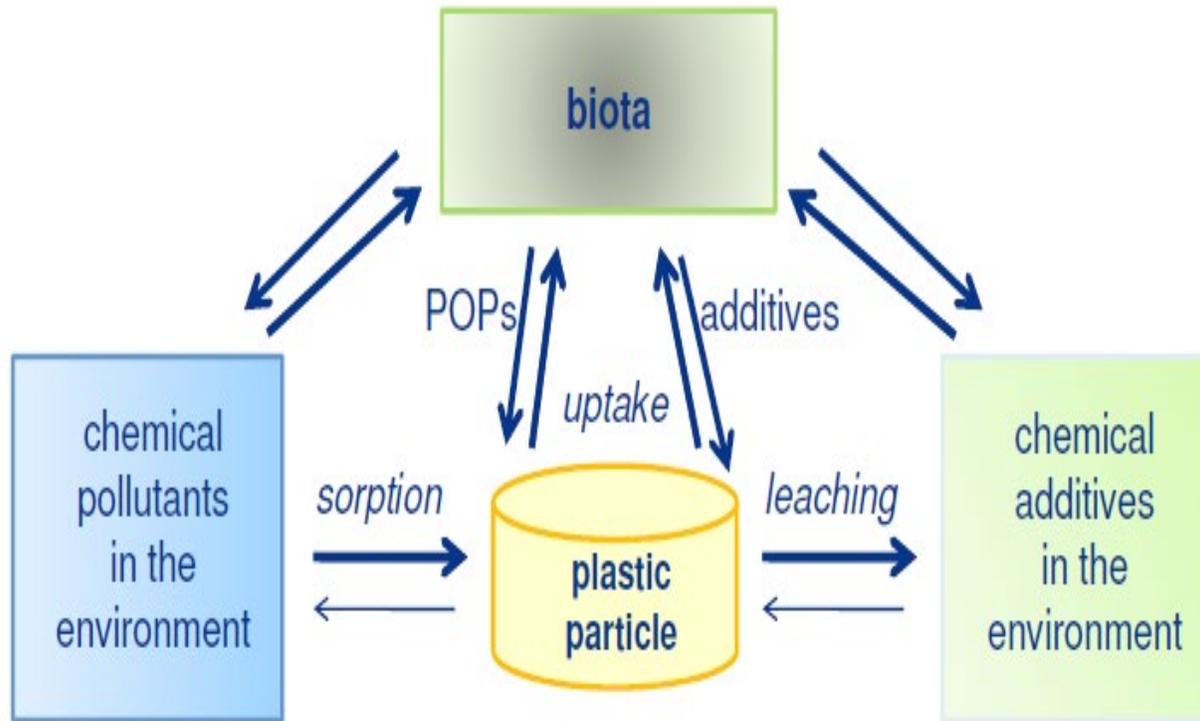
Species	MP exposure and effect	Reference
Human lymph and circulatory system	Absorption of PE particles <b>taken up in lymph and circulatory system</b> from gastro-intestinal tract	Hussain et al. 2001
<b>'Particle toxicity'</b>		
Rat	Lung <b>inflammation and enzyme activities</b> were affected, with increasing severity as particle size decreased	Brown et al. 2001
Human airway smooth muscle cell	Fluorescent 40 nm PS particles <b>decreased cell contractility</b>	Berntsen et al. 2010
Human endothelial cells (blood vessels)	Carboxyl PS latex beads in sizes of 20-500 nm were tested. 20 nm PS particles induced <b>cellular damage</b> through apoptosis and necrosis	Fröhlich et al. 2010

# Additif dan sisa Monomer dalam Plastik



- Plasticiser dalam PVC: DOP, DBP Dioktilphtalat, Dibutilphtalat
- BPA, BisPhenol A dalam Polycarbonat, PC
- Flame Retardan, PBDE pada plastik untuk Peralatan listrik dan electronic
- Styrena dalam Busa Poystirena (contoh styrofoam)
- Antistatic pada kantong PP dan PE
- PBDE pada WEEE, waste electronic dan Electrical Equipment
- Residu Asetal dehyde dalam botol PET

# POP dan Microplastic



# Upaya untuk menggunakan larva mengkonsumsi sampah plastik

Gathering of **wax worm** to degrade heap-up plastics. The worms live in honeycombs, where they feed on wax. 100 wax worms degrade 9 milligrams of a plastic shopping bag. At this rate, it will take 100 worm nearly a month to completely break down an average of 5.5gram plastic bag.



**Wax worms**

